DEFOLIATORS

Fewer defoliator plots (27 plots) were visited during the 1999 aerial survey than in previous years (52 plots) throughout southeast Alaska. An effort was made to distribute these plots evenly across the archipelago.

The objectives during the 1999 season were to:

- Spend more time covering the landscape during the aerial survey,
- Allow more time to land and identify unknown mortality and defoliation, and
- Avoid visit sites that were hard to get to and had few western hemlocks.

Hemlock sawfly and black-headed budworm larvae counts were generally low in 1999 as they were in 1998. The highest sawfly larvae counts were from the plots in Thorne Bay and Kendrick Bay, Prince of Wales Island. Larval counts are used as a predictive tool for outbreaks of defoliators. For example, if the larval sample is substantially greater in 1999, then an outbreak would be expected in 2000.

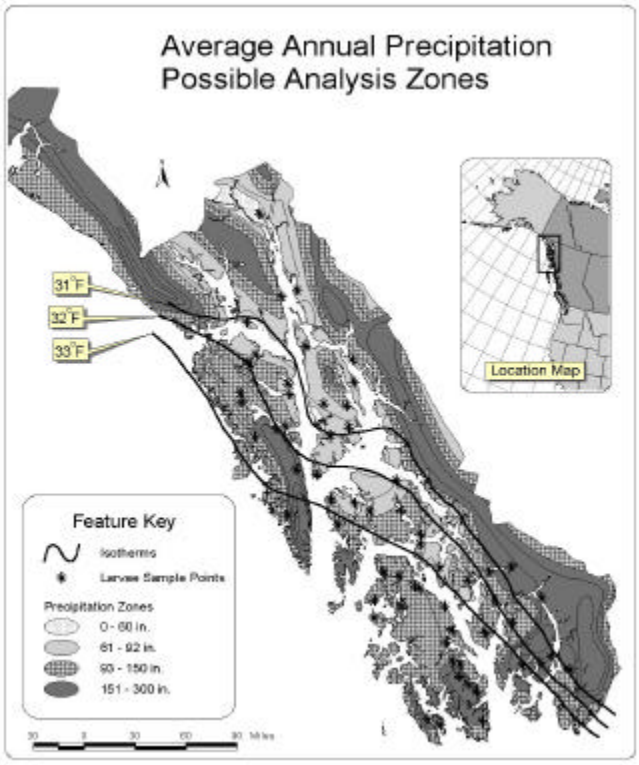

Figure 6. The above map displays mean annual precipitation for southeast Alaska, 1941-70, with winter isotherm and defoliator larvae sampling plots. The above classification will be used in an attempt to spatially analyze insect activity throughout southeast Alaska. Reference is made to this map in selected insect sections. ***(Precipitation information from Schwartz, F.K., and Miller, J.F. 1983. Probable maximum precipitation and snowmelt criteria for southeast Alaska: National Weather Service Hydrometeorological Report No. 54. 115p. GIS layer created by: Tim Brabets, 1997.*** *URL:http://agdc.usgs.gov/data/usgs/water)*

Spruce Needle Aphid

Elatobium abietinum Walker

Spruce needle aphids feed on older needles of Sitka spruce, often causing significant amounts of needle drop (defoliation). Defoliation by aphids cause reduced tree growth and can predispose the host to other mortality agents, such as the spruce beetle. Severe cases of defoliation alone may result in tree mortality. Spruce in urban settings and along marine shorelines are most seriously impacted. Spruce aphids feed primarily in the lower, innermost portions of tree crowns, but may impact entire crowns during outbreaks. Outbreaks in southeast Alaska are usually preceded by mild winters.

Following the mild winter of 1991-92, spruce needle aphid populations expanded rapidly in southeast Alaska, causing over 25,000 acres of Sitka spruce defoliation. Populations crashed in 1993 due to extended periods of sub-freezing temperatures during January and February. After a slight resurgence of activity in 1994, the 1995 population levels were low. Another outbreak occurred in 1998 following another mild winter, resulting in 46,300 acres of defoliation. Southeast Alaska accounted for 44,300 acres with 39,100 of those acres on national forest lands.

In 1999, just over 4,000 acres of defoliation were detected, a 91% reduction from 1998 acres. Only 2800 acres were defoliated on the Tongass National Forest compared to 39,100 acres in 1998, a 93% decline in acres. Much (76%) of the 1999 acres were in the warmest winter zone (≥ 33°F for the average temperature of December, January, and February combined [Anderson 1955])(***Figure 6***). Twenty percent and 4% were in the ≥32°F to <33°F and ≥31° to <32°F temperature zones, respectively. Most (96%) of the total acres were in precipitation zone 3, and the other 4% were in precipitation zone 2. Climatically, many of the acres aerially detected in 1999 were in the warm-wet zone of Southeast Alaska.

Western Black-Headed Budworm

Acleris gloverana Walsingham

The black-headed budworm is native to the forests of coastal and southwestern Alaska. It occurs primarily in southeast Alaska and has been documented there since the early 1900's. Budworm populations in Alaska have been cyclic, arising quickly, impacting vast areas, and then subsiding within a few years.

In southeast Alaska, a peak year for budworm defoliation occurred in 1993, totaling 258,000 acres. The last budworm outbreak of this magnitude occurred from the late 1940's to mid-1950's. Cool-wet weather in early summer months retards the growth and development of the budworm and may have resulted in population declines. Black-headed budworm populations crashed in 1995. In 1998 and 1999 no budworm defoliation was aerially detected.

Due to adverse flying conditions, we were unable to examine forest health conditions in Prince William Sound (M244A, M245A) in 1999. In 1996 and 1997, approximately 30,000 acres of defoliation were observed. However, reports from ground personnel indicate that the recent outbreak of the western black-headed budworm has substantially declined. This is most likely due to the cool, wet weather the Sound experienced this spring. Inclement weather is often a major limiting factor in budworm outbreaks. We expect to survey this area in 2000.

Figure 7. Progression of top-kill following repeated defoliation.

Hemlock Sawfly

Neodiprion tsugae Middleton

Hemlock sawfly, a common defoliator of western hemlock, is found throughout southeast Alaska. Historically, sawfly outbreaks in southeast Alaska have been larger and of longer duration in areas south of Frederick Sound (M245B). In 1999, sawfly defoliation was virtually nonexistent, this coming after a 59% decrease in 1998 from 1997 levels when 2,500 acres were recorded.

Of the 89 acres of hemlock sawfly defoliation detected in 1999, 64% of the acres were in warmest winter temperature zone while 36% were in the ≥32°F to <33°F zone. Twenty percent of the acres were in precipitation zone 3, 80% were in wettest precipitation zone 4. Climatically, many of the acres were in the warm-wet zone of southeast Alaska. ***Figure 6*** illustrates the above referenced climatic zones.

Unlike the larvae of the black-headed budworm, hemlock sawfly larvae feed in groups, primarily on older hemlock foliage. These two defoliators, feeding in combination, have the potential to completely defoliate western hemlock. Heavy defoliation of hemlock by sawflies is known to cause reduced radial growth and top-kill. Hemlock sawflies may ultimately influence both stand composition and structure in some areas. The sawflies themselves are a food source for numerous birds, other insects, and small mammals.

Spruce Budworm and Coneworm

Choristoneura fumiferana (Clemens)
Choristoneura orae (Freeman)
Dioryctria reniculelloides Mutuura & Munroe

Acres of defoliation attributed to the eastern spruce budworm and coneworm significantly decreased in 1999. Only 708 acres of light to moderately defoliated spruce were noted in 1999 vs. 87,800 acres noted in 1998. This budworm/coneworm defoliation occurred along the Yukon River from Ruby to Weir Island (131A). It appears that after more than five consecutive years, the budworm/coneworm outbreak has declined probably due to the increasing affects of parasites and predators. We expect little defoliation next year. A ground survey, conducted in late summer of 1999 by Tanana Chief Council crews, noted no mortality associated with the budworm/coneworm outbreak, although top-kill was prevalent. Little *Ips* spp. activity was noted in previously defoliated spruce stands.

Larch Sawfly

Pristiphora erichsonii (Hartig)

Total acres of land affected by the larch sawfly in 1999 were 189,576 acres; a significant reduction from the more than 450,000 acres of defoliated larch observed in 1998.

The area of most intense activity remains the vast area between McGrath and the Alaska Range (131B). After seven years of heavy defoliation, larch mortality is occurring. The concern still exists that larch beetle may begin to build up in these heavily defoliated stands which could result in further mortality. Virtually every ecosection in interior Alaska where larch occurs is experiencing larch sawfly activity. The Alaska Cooperative Extension Integrated Pest Management Technicians noted localized defoliation of Siberian larch in the Mat-Su Valley and Anchorage Bowl. This is the first time the sawfly has been recorded south of the Alaska Range and no doubt represents an accidental introduction. Efforts are being undertaken to eradicate this pest from these areas as Siberian larch is widely used as an ornamental in urban settings.

Figure 8. Larch sawfly larvae

Birch Defoliation

Fenusa pusilla (Lepeletier)
Euceraphis betulae (Koch.)

For the third consecutive year, birch defoliation was very noticeable in the Anchorage Bowl (213B). Birch aphids (*E. betulae*) were more noticeable early in the season. In late July and August, the Birch miner (*F. pusilla*) was responsible for additional defoliation. Although the hardwoods have been defoliated for several consecutive years, as yet there doesn't appear to be any lasting damage.

Large populations of birch aphid are responsible for honeydew, leaf-curling, and browning. Birch aphids are small and greenish-brown; they may be winged or wingless. Aphids usually over-winter as eggs, hatch in the spring as females that can reproduce without mating, and give birth to live young. Aphids are very responsive to changes in temperature. During warm dry summers, enormous aphid populations can develop in a relatively short time. Even so, aphid damage to Alaska birch forests is negligible.

The birch leafminer was first reported in eastern United States in 1923. Introduced from Europe, it has spread rapidly throughout the northern United States, Canada, and Alaska. The adult sawfly is black, about 3 mm long, and similar in appearance to a common fly. Larvae overwinter in cocoons in the soil and adults appear in the spring when the first birch leaves are half grown. The female sawfly deposits her eggs singly on newly developing leaves. At times, almost every leaf is mined by the developing larvae, giving it a brown color. When mature, the larva cuts a hole through the leaf and drops it to the ground. There the larvae build a cell in which pupation takes place; 2-3 weeks are usually required for transformation into the adult stage. A re-flushing of leaves may occur, and a second generation of egg-laying sawflies may develop. Two to four generations of this insect can develop in northeastern US; the number of generations in Alaska is not known.

Large Aspen Tortrix

Choristoneura conflictana Wlkr.

Acres of aspen affected by tortrix populations throughout Alaska declined in 1999 by 41% to only 13,336 acres. This decline is consistent with the cyclic nature of these insects. The outbreaks were located almost exclusively in interior Alaska with the exception of one area of small-scale, but persistent activity located near Skilak Lake on the Kenai Peninsula (213B). A large decline was noted in this population as well, falling from over 14,000 acres in 1998 to only 578 acres in 1999.

The most active areas were found to be near Fairbanks along the Tanana (131A), Nenana and Kantishna Rivers (131B), along the Yukon River between Henry and Weir Islands (M139A), approximately 50 miles downriver from Tanana and on the Hoholitna River (131B) about 30 miles southeast of Sleetmute. Smaller, yet quite active populations were located near Nabesna and on the Innoko River near Ophir (131A).

Historically, populations of tortrix tend to cycle over time in response to environmental conditions. A pattern of one to two years of increasing activity followed by two to three years of decline remains fairly consistent. Weather, starvation and parasites are the most important factors in precipitating these declines. In severe infestations, complete stripping of aspen foliage before the last instar larvae develop will reduce populations due to widespread starvation. In terms of acres affected by tortrix populations, the disparity between epidemic and endemic populations can be quite dramatic. Statewide, from 1966-1969, nearly 6,000,000 acres of active infestations were observed, while in 1985, only 2,000 acres were noted. Thus, it is quite difficult to make predictions about the future course of action of these highly variable populations of insects.

Gypsy Moth

Lymantria dispar (L.)

The European gypsy moth was accidentally introduced into the eastern U.S. in the late 1800's. Since then, the gypsy moth has been responsible for considerable damage to the hardwood forests of the east. The gypsy moth has been also introduced to the western U.S. where millions of dollars have been spent on its eradication.

Figure 9. Gypsy moth larvae

Since 1986, Forest Health Protection, in conjunction with Alaska Cooperative Extension and USDA APHIS, has placed gypsy moth pheromone monitoring traps throughout Alaska. To date, only two European gypsy moths have been trapped in Alaska. As far as we know, populations of the gypsy moth have not been established in Alaska. Due to the detection of the Asian gypsy moth (a more damaging race of the European gypsy moth) in the Pacific Northwest, more than 200 detection traps were placed throughout Alaska in 1999. No Asian or European gypsy moths were collected. If the Asian gypsy moth becomes established in the western U.S., including Alaska, the potential impacts to forest and riparian areas could be tremendous. The trapping program will be continued next year.

Cottonwood Leaf Beetle

Chrysomela spp**.**

Moderate cottonwood defoliation was noted throughout interior Alaska by the cottonwood leaf beetle. The beetles were once again observed in localized areas throughout the Anchorage Bowl (213B). Forest Health Protection staff and Alaska Cooperative Extension personnel received numerous calls from concerned citizens regarding the defoliation and the larvae. The feeding larvae are black, segmented grubs with two rows of white dots along their back. Larvae skeletonize the leaves by feeding on the surface of the leaf, resulting in a scorched appearance. The adult beetles are black with orange markings and are often mistaken for large ladybug beetles. Adults overwinter in leaf litter. Removal of leaf litter can help to reduce beetle numbers.

Willow Leaf Blotchminer

Micrurapteryx salicifolliela (Chambers)

The outbreak of the willow leaf blotchminer rose dramatically again in 1999. This year, defoliation rose to 180,396 acres vs. 123,070 acres noted in 1998. As in the past, the majority of the blotchminer activity is located in the upper Yukon River Flats area (139A) and the rivers that drain into the Yukon throughout this region (131A, B, M139A, B, C, and M129A). The infestation of the blotchminer probably covers many more acres than actually observed. Oftentimes, the brown-appearing, defoliated willow stretches as far as one can see from the air; however, cost prohibits more thorough coverage. Some willow mortality has been observed and the concern remains that widespread mortality may have a detrimental effect on availability of willow sprouts, upon which moose depend heavily as a food source.

This insect was not known in Alaska previously. There is one generation per year with the pupal stage as the overwintering stage. Ten species of willows have been observed infested, the severity of which differed somewhat between localities and species. Feltleaf willow, *Salix alaxensis*, is not infested due to

its under leaf surface being covered by a protective felt-like mat of hairs that prevents attachment of blotchminer eggs.

Alder Woolly Sawfly

Eriocampa ovata (L.)

Moderate defoliation of Sitka and thinleaf alder was observed for the third consecutive year in many parts of the Anchorage Bowl (213B). Heavy defoliation was also observed throughout southeast Alaska on red alder. This sawfly is a European species now established throughout the northern U.S., Canada, and Alaska. The larvae are covered with a distinctive shiny, woolly secretion. They skeletonize the lower leaves on young alders; the upper crown is usually not fed upon. Populations are expected to decline next year as a result of this summer's cool and wet conditions.

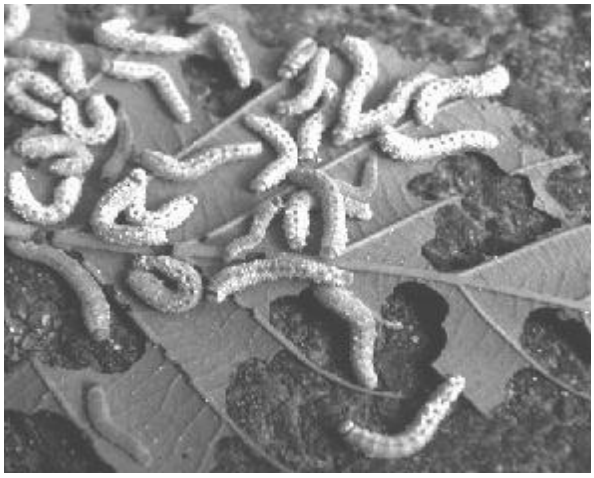

Figure 10. Alder woolly sawfly larvae

Spotted Tussock Moth

Lophocampa maculata (Harris)

Light to moderate defoliation of blueberry (*Vaccinium* sp.) and Sitka alder (*Alnus sinuata*) has been observed during the summer of 1999 from Wrangell Island south to Ketchikan (M245B). The causal agent was determined to be the spotted tussock moth (*Lophocampa maculata* (Harris). The name Spotted comes for the spotted fore wings of the adult (white spots on a buff background). The name Tussock refers to the long tufts of hair that extend beyond the body of the caterpillar. The mid-abdominal segments of the early instar caterpillars have red hairs among bright yellow hairs. The anterior and posterior have long wisps of white hairs with shorter yellow and black hairs. The mid-abdominal segments of the late instar has wisps of long white hairs among reddish-orange hairs; the anterior and posterior is predominantly black with long wisps of white hairs among short black hairs. They are commonly known elsewhere as woolly bears. The gray cocoon is formed from the long body hairs and silk; they probably overwinter in the leaf litter layer. The adult probably emerges in spring. Different forms of this Lepidopteran live throughout western North America.

MISCELLANEOUS FOREST INSECTS

Hawkmoth

Hyles galii (Rottenburg)

Moderate to heavy defoliation of fireweed (*Epilobium* spp.) and other perennials by hawkmoth larvae has been observed throughout Alaska. The larval body is black with a red head, horn, and eyespots (along body). In addition, the body also has rows of small yellow spots. The adult is a good flyer with a pale band down the middle of the fore-wing and red in the hind-wing. The adults feed on flower nectar and are seen from May to August. Larvae feed on fireweed until late fall then overwinter as a cocoon in the leaf litter. Many people are frightened and delighted by the moth that appears to fly like a bird. This hawkmoth is known as the bedstraw hawkmoth because it feeds on bedstraw (*Galium* spp.). It is found across North America from the east coast to Colorado and California, north to the Canada and Alaska.

Sitka Spruce Weevil

Pissodes strobi Peck

Adult Sitka spruce weevils were collected for the first time in the Anchorage Bowl in 1995 and again in 1996-97. The weevils were collected from infested nursery stock (blue spruce) brought into the state from the Pacific Northwest. Developing larvae, pupae, and callow adults were encountered in 1998 in out-plantings of spruce in west Anchorage; an indication that the spruce weevil may have adequate developmental conditions to become established in south-central Alaska. A follow-up ground check in the west Anchorage area found no new Sitka spruce weevil activity on new out-plantings. All of the infested shoots seen in this area were clipped and

disposed of. In 1999, Sitka spruce weevils were found in a State of Alaska, Department of Transportation landscape planting near Tudor Road and "C" St. in Anchorage. The infested terminals were clipped and destroyed. We will continue to monitor the potential establishment of this serious pest of ornamental and native spruce.

Spider Mites: Acarina

***Paratetranychus* spp. and *Tetracychus* spp.**

The Anchorage IPM Technicians (Alaska Cooperative Extension) noticed extensive damage to spruce trees from spider mite feeding in 1999. This damage was most visible in August and September. Infested trees showed signs of yellowing needles in a "flagging" pattern and green needles appeared dull in color with much webbing present. Some defoliated trees exhibited an overall decline in appearance and then dropped the faded needles. Weeks of warm, dry weather early in the spring may have contributed to the abundance of spider mites.

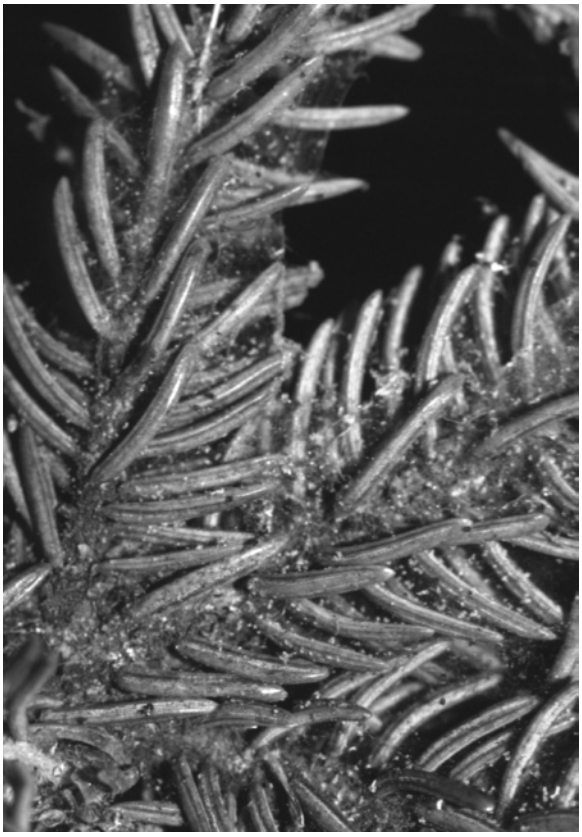

Figure 11. Webbing is initially apparent with spider mite feeding. Needles will become discolored and fall off.

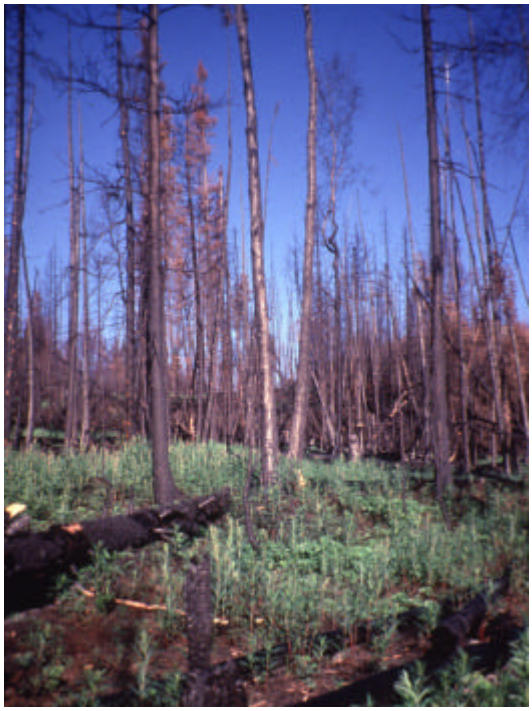

Figure 12. Fire followed a spruce beetle infestation in the Hidden Lakes area. Fire and insects are key agents in forest disturbance.

Figure 13. Old spruce beetle mortality in a high volume stand of southeast Alaska.

Figure 14. Willow defoliation has been recorded on over180,000 acres throughout the interior of Alaska in 1999.

Figure 15. This year larch sawfly were responsible for nearly 160,000 acres of larch defoliation in Alaska. An adult larch sawfly is pictured above.